

Human Exploration and Development of Space Enterprise (HEDS)

Mission

As we enter a new millennium, people the world over are reflecting on the accomplishments of the past and speculating about opportunities of the future. Some of the most inspiring and important accomplishments of the past four decades have resulted from the space program: events such as the planet-wide impact of the Apollo landings on the moon and images of the Earth; discoveries such as the astonishing Hubble Space Telescope (HST) photos of solar system formation; achievements such as the sending of the first human spacecraft—Pioneer and Voyager spacecraft—beyond our solar system; and new capabilities such as communications and weather satellites. Space has touched the lives of many hundreds of millions worldwide.

The mission of HEDS is to expand the frontiers of space and knowledge by exploring, using, and enabling the development of space for human enterprise. To achieve this mission, NASA's Human Exploration and Development of Space (HEDS) Enterprise is pursuing four strategic goals:

- Explore the space frontier
- Enable humans to live and work permanently in space
- Enable the commercial development of space, and
- Share the experience and benefits of discovery

We begin with the foundation of the Space Shuttle and the International Space Station, now under construction in Earth orbit, and look to the future by initiating technology development and commercialization in space.

We also aspire to make possible U.S. leadership of international efforts to extend permanently human presence beyond the bounds of Earth, involving both machines and humans as partners in innovative approaches to exploration. We will engage the private sector in the commercial development of space in order to enable the continuation of current space business and the creation of new wealth and new jobs for the U.S. economy.

Accomplishment of these goals will enable historic improvements in our understanding of nature, in human accomplishment, and in the quality of life. The Human Exploration and Development of Space Strategic Plan is a first step. This performance plan shows how we plan to measure our success.

Resource Requirements

(NOA, dollars in millions)

	<u>FY1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
\$M	\$6,045.8	\$5,977.9	\$5,972.5	\$7,248.2
CS FTE	7,209	7,416	7,779	8,092

Implementation Strategy

Goal 1 - Explore the Space Frontier

There are certain ideas that many believe to be inherent in the human psyche and integral to American culture: ambition for progress, curiosity about the unknown, the need to pose profound questions and to answer them, the concept of new frontiers that—once achieved—promise a better quality of life for all peoples. Space is such a frontier. Earth orbit, the Moon, near-Earth space, Mars and the asteroids, eventually the moons of the giant planets of the outer solar system, and someday more distant worlds—these are collectively the endless, ever-expanding frontier of the night sky under which the human species evolved and toward which the human spirit is inevitably drawn. It is a fundamental goal of NASA to expand the space frontier progressively through human exploration, utilization of space for research, and commercial development.

Strategic Objectives

- Invest in the development of high-leverage technologies to enable safe, effective and affordable human/robotic exploration.
- Conduct engineering research on the International Space Station to enable exploration beyond Earth orbit.
- Enable human exploration through collaborative robotic missions.
- Define innovative human exploration mission approaches.
- Develop exploration/commercial capabilities through private sector and international partnerships.

Goal 2 - Enable Humans to Live and Work Permanently in Space

Advances in technology notwithstanding, the human element continues to be the major factor in the success or failure of most terrestrial enterprises. In many cases, innovative technologies are most effective when used to leverage or enhance the productivity of humans. Moreover, the human element is a quintessential component in the public's continuing interest in, and support for the space program. Human presence will be an essential factor in successfully opening the space frontier and expanding knowledge through research in space. As our activities in space grow, so too must human involvement. In this way, we open the door to an array of benefits, tangible and intangible, for the people of the United States and the world. It is, therefore, a goal of NASA to enable and establish permanent and productive human presence in space, to advance America's aspirations and opportunities in space through new technologies and new ways of doing business.

Strategic Objectives

- Provide and make use of safe, affordable, and improved access to space.
- Operate the International Space Station to advance science, exploration, engineering, and commerce.
- Ensure the health, safety, and performance of humans living and working in space.
- Meet sustained space operations needs while reducing costs.

Goal 3 - Enable the Commercial Development of Space

Commerce is essential to human society; free market transactions are the foundation of the dramatic progress humankind has made during the past several centuries. Wherever humans go and wherever they live, there too is commerce. Moreover, the free market is an effective mechanism for delivering tangible benefits from space broadly to the American people.

If humanity is to explore and develop space, to better exploit the space environment for profound scientific discoveries, and someday to settle the space frontier, it may be through the continuing expansion of the private sector—of individuals and of industry—into space. As we open the space frontier, we must therefore seek to expand the free market into space.

It is a goal of NASA to enable the commercial development of space.

Strategic Objectives

- Improve the accessibility of space to meet the needs of commercial research and development.
- Foster commercial endeavors with the International Space Station and other assets.
- Develop new capabilities for human space flight and commercial applications through partnerships with the private sector.

Goal 4 - Share the Experience and Benefits of Discovery

Americans—of all backgrounds—should have the opportunity to share in the experience and benefits of space exploration and development. During the past four decades, ambitious human space flight missions have inspired generations of young people to undertake careers in science, mathematics, and engineering—benefiting both themselves and society. The space program can enrich society by directly enhancing the quality of education. Terrestrial applications of technologies developed for space have saved many lives, made possible medical breakthroughs, created countless jobs, and yielded diverse other tangible benefits for Americans. The further commercial development of space will yield still more jobs, technologies, and capabilities to benefit people the world over in their everyday lives. A goal of NASA is therefore to share the experience, the excitement of discovery, and the benefits of human space flight with all.

Strategic Objectives

- Engage and involve the public in the excitement and the benefits of—and in setting the goals for—the exploration and development of space.
- Provide significantly more value to significantly more people through exploration and space development efforts.
- Advance the scientific, technological, and academic achievement of the Nation by sharing our knowledge, capabilities, and assets.

Performance Measures

Goal 1: Explore the Space Frontier

Objective: Invest in the development of high-leverage technologies to enable safe, effective and affordable human/robotic exploration.

Public Benefit: Pursuing the technologies that will be needed for future ambitious missions of human/robotic exploration of space will make possible an expanded scope for human commerce and an improved quality of life by enabling potential high-value new space industries (e.g., advanced communications satellites, manufacturing in space, R&D in space, public space travel, space utilities, and others) while improving the quality of life (e.g., through advances in our understanding of human physiology and human factors, in medicine and medical systems) and advancing the general economy (through the application of these technologies in terrestrial commercial markets).

Annual Performance Goal 2H01: Begin the development of high-leverage technologies to enable safe, effective and affordable human/robotic exploration missions beyond LEO.

- Select and fund at least 10-15 cooperative R&D projects through the HTCI focused R&T program, addressing common and competing technologies for human/robotic missions beyond LEO.

Objective: Conduct engineering research on the International Space Station to enable exploration beyond Earth orbit.

Public Benefit: Many of the key technologies needed for future human/robotic exploration and development of space will require testing and later demonstrations in the actual space environment before they can be cost-effectively applied in future space systems. Conducting engineering research and development at the ISS, will result in more timely, affordable and successful application of these new technologies (including the capability to design to cost and implement to cost for future HEDS projects). In addition, the space application of these technologies will result in expanded scope for human commerce and an improved quality of life by enabling potential high-value new space industries (e.g., advanced communications satellites, manufacturing in space, R&D in space, public space travel, space utilities, and others) while improving the quality of life (e.g., through advances in our understanding of human physiology and human factors, in medicine and medical systems).

Annual Performance Goal 2H02: Test at the International Space Station competing technologies for human missions beyond LEO, in cooperation with other agencies and international partners, and with US industry.

- Complete preliminary definition of no fewer than 5 potential technology flight experiments and demonstrations that could be implemented at the International Space Station.

Objective: Enable human exploration through collaborative robotic missions.

Public Benefit: A better understanding (at the earliest possible dates) of the space and planetary environments to which human explorers will one day travel will make possible a more focused, more effective and lower cost investment to develop the

technologies needed for future human/robotic exploration and development of space. This knowledge and understand will also make possible reduced risks to the health and safety of future astronauts. Overall, pursuing collaborative robotic missions will result future human/robotic exploration missions with lower costs and greater benefits that would be otherwise achievable.

Annual Performance Goal 2H03: Provide reliable launch services for approved missions.

- NASA success rate at or above a running average of 95% for missions noted on the Flight Planning Board manifest and launched pursuant to commercial launch service contracts.

Objective: Define innovative human exploration mission approaches.

Public Benefit: New concepts at all levels – technologies, systems and architectures – are needed to make possible dramatic reductions in the anticipated costs and risks, and substantial increases in the returns and benefits expected from future human/robotic exploration missions beyond low Earth orbit. In addition, these innovative approaches are anticipated to provide a viable foundation for many opportunities to advanced the commercial development of space, making possible a range of future new space industries (e.g., R&D in space, advances in space communications, etc.) that will promote the continuing strength of the US aerospace industry in the world economy.

Annual Performance Goal 2H04: Identify and evaluate candidate approaches for 100- to 1000- day human missions capable of a 5- to 10- fold cost reduction--while increasing safety and effectiveness (compared to 1990s projections).

- Select and fund at least 5 proposals through the HTCI focused R&T program that feature: (1) highly innovative new advanced systems concepts and architecture studies for HEDS/OSF, and (2) a range of mission studies examining potential future options.

Objective: Develop exploration/commercial capabilities through private sector and international partnerships.

Public Benefit: The use of private sector partnerships to develop exploration/commercial capabilities will accelerate the timely commercial application of the new technologies and concepts emerging from human/robotic exploration efforts – moving forward the date when public benefits can be expected. In addition, by involving the US private sector in the development of the needed technologies early on will enhance the subsequent development and conduct of exploration missions, resulting in lower risks and costs in future projects. Similarly, engaging international partners in the pursuit of appropriate exploration/commercial capabilities will make possible well-chosen and more-effective international collaboration in the conduct of future missions, reducing the costs and risks for the US of future projects.

Annual Performance Goal 2H05: Develop and test --on the ground and in space-- competing technologies for human missions beyond LEO in cooperation with international partners.

- Organize and conduct an "international forum" at which preliminary concepts, plans and technology options for future human/robotic exploration and development of space are reviewed.

Goal 2: Enable Humans to Live and Work Permanently in Space

Objective: Provide and make use of safe, affordable, and improved access to space.

Public Benefit: Successfully meeting goal 2H06 allows researchers to apply the knowledge gained from flying payloads on the Space Shuttle thus assuring a positive return on the public's investment in space transportation

Annual Performance Goal 2H06: Assure public, flight crew, and workforce safety for all Space Shuttle operations, measured by the following:

- Achieve zero type A or B mishaps in FY 2002.
- Achieve an average of 8 or fewer flight anomalies per Space Shuttle mission

Public Benefit: Successfully meeting goal 2H07 allows researchers to apply the knowledge gained from flying payloads on the Space Shuttle thus assuring a positive return on the public's investment in space transportation

Annual Performance Goal 2H07: Safely meet the FY 2002 manifest and flight rate commitment. Annual performance goal is measured for Space Shuttle performance only.

- Achieve 100% on-orbit mission success for all flights in FY 2002. For this metric, mission success criteria are those provided to the prime contractor (SFOC) for purposes of determining successful accomplishment of the performance incentive fees in the contract.

Public Benefit: Ensuring the most effective and efficient access to space for primary payload customers while supporting the safety and reliability of the Shuttle transportation system.

Annual Performance Goal 2H08: Maintain a "12-month" manifest preparation time.

- Baseline Flight Requirements Document (FRD) tracks achievement of this goal and it defines the primary cargo manifest that uses the "12 month" template.

Public Benefit: Ensuring a safe and reliable space transportation system that maximizes long-term benefits to the public through support to the ISS program and other primary payload customers.

Annual Performance Goal 2H09: Have in place a Shuttle safety investment program that ensures the availability of a safe and reliable Shuttle system for ISS assembly and operations.

- Meet the major FY 2002 Space Shuttle Safety Upgrade milestones. For this metric, major milestones are defined to be the Preliminary Design Review dates, Critical Design Review dates, Ready dates for upgrade installation/integration with flight hardware/software, and Ready dates for first flight

Objective: Operate the International Space Station to advance science, exploration, engineering, and commerce.

Public Benefit: Meeting operations targets and beginning research activities will provide many benefits of space research directly to the public through new discoveries and improved technology applications in areas such as medicine, industrial processes and fundamental knowledge.

Annual Performance Goal 2H10: Demonstrate ISS on-orbit vehicle operational safety, reliability, and performance.

- Zero safety incidents (i.e. no on-orbit injuries)
- Actual resources available to the payloads measured against the planned payload allocation for power, crew time, and telemetry. (green = 80% or greater)

Public Benefit: Meeting development targets and beginning research activities will provide many benefits of space research directly to the public through new discoveries and improved technology applications in such areas as medicine, industrial processes and fundamental knowledge.

Annual Performance Goal 2H11: Demonstrate ISS program progress and readiness at a level sufficient to show adequate readiness in the assembly schedule.

- Conduct monthly status reviews to show maturity and preparation of flight readiness products. Maintaining 80% of defined activities are within scheduled targets (green).

Public Benefit: Improving life on Earth. Successfully implementing goal 2H12 brings the many benefits of space research directly to the public through new discoveries and improved technology applications in areas such as medicine, industrial processes and fundamental knowledge.

Annual Performance Goal 2H12: Successfully complete 90% of the ISS planned mission objectives.

- Achieve 90% on-orbit mission success for planned ISS assembly and logistics activities on the Space Shuttle flights scheduled for FY 2002.
- Sum total of the successfully accomplished primary mission objectives divided by the total number of mission objectives per year.

Public Benefit: Improving life on Earth. Successfully implementing goal 2H13 brings the many benefits of space research directly to the public through new discoveries and improved technology applications in areas such as medicine, industrial processes and fundamental knowledge.

Annual Performance Goal 2H13: Demonstrate progress toward ISS research hardware development.

- Conduct end of the year review to show payload facility development to planned comparison. Maintaining actual schedule within 15% of original planned schedule for that year-- green.

Objective: Ensure the health, safety, and performance of humans living and working in space.

Public Benefit: Competition that promotes partnering of industries and academia with NASA to discover new approaches and technologies can help NASA achieve its goals while creating new business opportunities and supporting education.

Annual Performance Goal 2H14: Select and fund at least 3-5 proposals through the HTCI focused R&T program that feature:

- Highly innovative new technology development efforts in selected areas associated with human safety and performance in space (e.g., Extravehicular Activity (EVA) systems)
- Using a competitive solicitation process, select, fund, and complete the first round of:
 - Highly innovative new technology development efforts in selected areas associated with human safety and performance in space (e.g., Extravehicular Activity (EVA) systems) through the HTCI focused R&T program.

Objective: Meet sustained space operations needs while reducing costs.

Public Benefit: The public's investment in space operations demands NASA's attention to safety first and cost reduction whenever possible. We are accountable for maximizing the return on the public's investment.

Annual Performance Goal 2H15: The Space Communications program will conduct tasks that enable commercialization and will minimize investment in government infrastructure for which commercial alternatives are being developed.

- Increase the percentage of the space operations budget allocated to the acquisition of communications and data services from the commercial sector from 15% in FY01 to 20% in FY 2002.

Public Benefit: The public's investment in space operations demands NASA's attention to safety first and cost reduction whenever possible. We are accountable for maximizing the return on the public's investment.

Annual Performance Goal 2H16: Performance metrics for each mission will be consistent with detailed program and project operations requirements in project Service Level Agreements

- Achieve at least 95 percent of planned data delivery for space flight missions.

Goal 3: Enable the Commercial Development of Space

Objective: Improve the accessibility of space to meet the needs of commercial research and development.

Public Benefit: Promote continuous research and development activities through the International Space Station assembly period.

Annual Performance Goal 2H17: Provide an average of five mid-deck lockers on each Space Shuttle mission to the International Space Station for research.

- Demonstrate that an average of five mid-deck lockers were used to support research on Space Shuttle Mission going to the ISS (source Space Station manifest).

Public Benefit: New commercially developed launch services will be able to compete for NASA launches when they meet NASA's risk mitigation policy.

Annual Performance Goal 2H18: Establish mechanisms to enable NASA access to the use of U.S. commercially developed launch systems.

- NASA launch service contracts in place or planned with annual on-ramps for newly developed commercial launch services as they meet NASA's risk mitigation policy.

Objective: Foster commercial endeavors with the International Space Station and other assets.

Public Benefit: NASA is undertaking reforms and developing a plan to ensure the future Space Station costs will remain within the President's FY2002 Budget plan.

Annual Performance Goal 2H19: Develop and execute a management plan and open future Station hardware and service procurements to innovation and cost-saving ideas through competition, including launch services and a Non-Government Organization for Space Station research.

- Implement management plan -- Management plan contains reforms that strengthen headquarters involvement, increases communications, provide more accurate assessment and maintains budget accountability.

Objective: Develop new capabilities for human space flight and commercial applications through partnerships with the private sector.

Public Benefit: Competition that promotes partnering of industries and academia with NASA to discover new approaches and technologies can help NASA achieve its goals while creating new business opportunities and supporting education.

Annual Performance Goal 2H20: Conduct a competitive solicitation and selection process that will fund through the HEDS research and technology (R&T) program HTCI (HEDS Technology and Commercialization Initiative):

- Systems studies assessing the commercial potential associated with various prospective HEDS infrastructures/capabilities,
- New technology development and demonstration efforts with potential longer-term commercial space value.
- Using a competitive solicitation process, select, fund, and complete the first round of:
 - Systems studies assessing the commercial potential associated with various prospective HEDS infrastructures/capabilities,
 - New technology development and demonstration efforts with potential longer-term commercial space value through the HTCI focused R&T program.
- Also;

- Develop, in conjunction with discussions with key international space organizations, and seek management approval for an approach for undertaking the formulation of international partnerships for the development and/or demonstration of HEDS capabilities.

Public Benefit: Progress in implementing 2H21 will transition NASA to the Research and Development (R&D) organization that was envisioned as its primary responsibility over 40 years ago. Partnership with commercial investors brings the results and benefits of living and working in space to the public more quickly than the government could do by itself.

Annual Performance Goal 2H21: Continue implementation of planned and new privatization efforts through the Space Shuttle prime contract and further efforts to safely and effectively transfer civil service positions and responsibilities to the Space Shuttle contractor.

- Pending completion of cost benefit analyses, add the Hamilton Sundstrand and Johnson Engineering contracts for Extravehicular Activity to the Space Flight Operations Contract (SFOC).
- Negotiate an extension of the Space Flight Operations Contract (SFOC) by the end of the Fiscal Year.
- Define criteria and get Space Flight Operations Contract (SFOC) contractor agreement for further contract consolidation and shuttle privatization, which assures maintenance of shuttle system safety.

Goal 4: Share the Experience and Benefits of Discovery

Objective: Engage and involve the public in the excitement and the benefits of—and in setting the goals for—the exploration and development of space.

Public Benefit: Continuing to improve public involvement in setting the goals HEDS activities will assure that future exploration and development of space programs are well aligned with the interests and the intentions of the primary constituents for NASA exploration programs, resulting overtime in programs and projects that are more cost-effective in achieving public goals and objectives.

Annual Performance Goal 2H22: Competitively select and fund at least 5 activities to identify potential opportunities for high public value HEDS activities, including potential media access and/or public involvement in future HEDS missions.

- Select and fund at least 5 proposals through the HTCI focused R&T program that feature studies to identify potential opportunities for high public value HEDS activities, including potential public involvement in future HEDS missions.

Objective: Provide significantly more value to significantly more people through exploration and space development efforts.

Public Benefit: Continuing to improve public involvement in the conduct of and results from future HEDS activities will assure that future exploration and development of space programs are well understood by the primary constituents for NASA exploration programs. In addition, more effective communication of the knowledge and technologies resulting from HEDS

activities will assure the move rapid transition of these innovations into private sector applications, with resulting benefits to the economy and quality of life.

Annual Performance Goal 2H23: Establish a focused customer engagement process to significantly increase our value to significantly more people by enabling the public to guide the formulation of HEDS goals, objectives, programs and missions.

- Develop, through one or more public meetings a HEDS outreach plan, featuring an approach to communicate broadly the new knowledge, breakthrough technologies and innovative capabilities associated with various prospective HEDS Enterprise activities.

Annual Performance Goal 2H24: Expand public access to HEDS missions information (especially ISS) by working with industry to create media projects and public engagement initiatives that allow “first-hand” public participation using telepresence for current missions, and virtual reality or mock-ups for future missions beyond Earth orbit.

- Museums – track the number of science museums and other informal education forums incorporating first person participation with the ISS.
- Public Web presence – track number and duration of visits to the HEDS website

Objective: Advance the scientific, technological, and academic achievement of the Nation by sharing our knowledge, capabilities, and assets.

Public Benefit: HEDS is an important investment in the future of the US. By advancing the academic achievements of the nation, HEDS can contribute to a better quality of life in the future by inspiring today's US students and faculty to excellence in the sciences, mathematics, and engineering. Similarly, by effectively advancing scientific and technological achievements, new discoveries and new industries will result, contributing to a stronger economy in the future.

Annual Performance Goal 2H25: Establish initial partnerships with educators at all levels (K-12 and universities) in order to increase the involvement of faculty and students in HEDS.

- Create no fewer than 10 "HEDS Student Challenge Projects" nation-wide, involving internet-based collaborative teams to bring educators, students and NASA technologists/scientists together to pursue innovative solutions to HEDS challenges.

Verification and Validation

Internal Assessment

Interim evaluation and monitoring of performance targets will be conducted – as required – as an element of regular meetings of the Office of Space Flight and HEDS Management Boards. As a matter of NASA policy, relevant HEDS performance targets are included in the HEDS portion of the NASA's performance plans submitted by the Associate Administrator of the Office of Space Flight.

Final data collection, reporting and verification for inclusion in the Annual Performance Report will rely on several different processes depending on the particular Annual Performance Goal. Wherever possible, a specific tangible product has been identified in the indicator for individual performance goals to strengthen the validation process.

For many HEDS performance goals, (e. g. Space Shuttle in-flight anomalies, Space Station assembly milestones) verification of performance is straightforward and progress is monitored through regular management channels and reports.

External Assessment

To assist in evaluating those performance goals that are more difficult to associate with specific tangible products, HEDS will employ an annual external assessment process. An OSF Advisory Committee reviews and evaluates OSF performance targets.

MULTI-YEAR PERFORMANCE TREND
Human Exploration and Development of Space Enterprise (HEDS)

Invest in the development of high-leverage technologies to enable safe, effective, and affordable human/robotic exploration.

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Explore the Space Frontier		0H38: In coordination with other Enterprises, develop and implement tests and demonstrations of capabilities for future human exploration in the areas of advanced space power, advanced space transportation, information and automation systems, and sensors and instruments.	1H32: Initiate the HEDS Technology/Commercialization program and establish a synergistic relationship with industry.	2H1: Begin the development of high-leverage technologies to enable safe, effective and affordable human/robotic exploration missions beyond LEO.
Assessment	N/A	Yellow	TBD	TBD

Conduct engineering research on the International Space Station to enable exploration beyond Earth orbit.

Explore the Space Frontier				2H2: Test at the International Space Station competing technologies for human missions beyond LEO, in cooperation with other agencies and international partners, and with US industry.
Assessment				TBD

Enable human exploration through collaborative robotic missions

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Explore the Space Frontier		OH35: Complete the integration and testing of the Mars In-situ Propellant Production Precursor (MIP) flight unit for the 2001 Mars Surveyor mission.	1H1: Complete testing and delivery for spacecraft integration of experiments for the Mars Surveyor Program 2001 missions.	
Assessment		Red	TBD	
Explore the Space Frontier				2H3: Provide reliable launch services for approved missions. <ul style="list-style-type: none"> NASA success rate at or above a running average of 95% for missions noted on the Flight Planning Board manifest and launched pursuant to commercial launch service contracts.
Assessment				TBD

Define innovative human exploration mission approaches.

Explore the Space Frontier				2H4: Identify and evaluate candidate approaches for 100- to 1000- day human missions capable of a 5- to 10- fold cost reduction-- while increasing safety and effectiveness (compared to 1990s projections).
Assessment				TBD

Develop exploration/commercial capabilities through private sector and international partnerships.

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Explore the Space Frontier				2H5: Develop and test --on the ground and in space-- competing technologies for human missions beyond LEO in cooperation with international partners.
Assessment				TBD

Provide and make use of safe, affordable and improved access to space.

Enable Humans to live and Work Permanently in Space	9H15: Achieve seven or fewer flight anomalies per mission	0H12: Achieve seven or fewer flight anomalies per mission	1H7: Achieve 8 or fewer flight anomalies per mission.	2H6: Assure public, flight crew, and workforce safety for all Space Shuttle operations, measured by the following: <ul style="list-style-type: none"> • Achieve zero type A or B mishaps in FY 2002. • Achieve an average of 8 or fewer flight anomalies per Space Shuttle mission
Assessment	Green	Green	TBD	TBD
Enable Humans to live and Work Permanently in Space	9H16: Achieve 85% on time, successful launches, excluding weather risk.	0H13: Achieve 85% on time, successful launches, excluding weather risk. Changed to: Achieve 100% on-orbit mission success.	1H30: Achieve 100% on-orbit mission success	2H7: Safely meet the FY 2002 manifest and flight rate commitment. Annual performance goal is measured for Space Shuttle performance only.
Assessment	Yellow	Green		TBD
Enable Humans to live and Work Permanently in Space	9H17: Achieve a 13-month manifest preparation time.	0H14: Achieve a 12-month manifest preparation time.		2H8: Maintain a "12-month" manifest preparation time.
Assessment	Green	Green		TBD

Provide and make use of safe, affordable and improved access to space.

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Enable Humans to live and Work Permanently in Space	9H18: Achieve a 60% increase in predicted reliability of Space Shuttle over 1995	0H15: Have in place an aggressive Shuttle program that ensures the availability of a safe and reliable Shuttle system through the ISS era.	1H6: Expedite a safety improvement program to ensure the continued safe operations of the Space Shuttle that ensures the availability of a safe and reliable Shuttle system to support Space Station Assembly milestones and operations.	2H09: Have in place a Shuttle safety investment program that ensures the availability of a safe and reliable Shuttle system for ISS assembly and operations.
Assessment	Green	Red	TBD	TBD

Operate the International Space Station to advance science, exploration, engineering and commerce.

Enable Humans to live and Work Permanently in Space		0H61: Conduct operations with a three-person human presence on the ISS.	1H12: Successfully complete the majority of combined ISS planned operations schedules and milestones as represented by permanent human on-orbit operations.	2H10: Demonstrate ISS on-orbit vehicle operational safety, reliability, and performance.
Assessment		Yellow	TBD	TBD
Enable Humans to live and Work Permanently in Space	9H42: Initiate full-scale Multi-Element Integration Testing (MEIT) for elements in the first four launch.		1H10: Successfully complete the majority of the planned development schedules and milestones required to support the Multi-element Integration Testing	2H11: Demonstrate ISS program progress and readiness at a level sufficient to show adequate readiness in the assembly schedule.
Assessment	Green		TBD	TBD

Operate the International Space Station to advance science, exploration, engineering and commerce.

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Enable Humans to live and Work Permanently in Space	9H44: Conduct physical integration of the Z1 Truss launch package and initiate MEIT.			
Assessment	Green			

Operate the International Space Station to advance science, exploration, engineering and commerce.

Enable Humans to live and Work Permanently in Space	9H43: Deliver the U.S. laboratory module to the launch site in preparation for MEIT.	0H16: Deploy and activate the U.S. Laboratory Module to provide a permanent on orbit laboratory capability.		
Assessment	Green	Yellow		
Enable Humans to live and Work Permanently in Space	9H19: Deploy and activate the Russian-built Functional Cargo Block as the early propulsion and control module.	0H18: Deploy and activate the Airlock to provide an ISS-based EVA capability.	1H11: Successfully complete the majority of the ISS planned on-orbit activities such as delivery of mass to orbit and enhanced functionality.	2H12: Successfully complete 90% of the ISS planned mission objectives.
Assessment	Green	Yellow	TBD	TBD
Enable Humans to live and Work Permanently in Space	9H41: Deploy and activate the first U.S.-built element, Unity (Node 1), to provide docking locations and attach ports.	0H17: Deploy and activate the Canadian-built Space Station Remote Manipulator System to provide an ISS-based remote manipulating capability for maintenance and assembly.		
Assessment	Green	Yellow		

Operate the International Space Station to advance science, exploration, engineering and commerce.

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Enable Humans to live and Work Permanently in Space		0H19: Deliver to orbit the first of three Italian-build Multi-Purpose Logistic Modules to provide a reusable capability for delivering payload and systems racks to orbit.		
Assessment		Yellow		
Enable Humans to live and Work Permanently in Space		0H20: Complete preparations for the initial ISS research capability through the integration of the first rack of the Human Research Facility (HRS-1), five EXPRESS racks with small payload research and the Microgravity Science Glovebox (MSG).	1H13: Successfully complete the majority of the planned research activities in support of initiation of on-orbit research opportunities	2H13: Demonstrate progress toward ISS research hardware development.
Assessment		Yellow	TBD	TBD
Enable Humans to live and Work Permanently in Space			1H14: Successfully complete no less than 85% of the planned Russian Program Assurance schedules and milestones required for the development of the Propulsion Module.	
Assessment			TBD	

Operate the International Space Station to advance science, exploration, engineering and commerce.

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Enable Humans to live and Work Permanently in Space		0H22: Complete the production of the X-38 first space flight test article in preparation for a Shuttle test flight in 2001.	1H15: Successfully complete no less than 75% of the planned crew return capability schedules. FY01 indicators will include accomplishment of program schedule milestones for Phase 1 development Of a crew return vehicle (CRV) that could provide the U.S. crew return capability.	
Assessment		Yellow	TBD	

Ensure the health, safety and performance of humans living and working in space.

Enable Humans to live and Work Permanently in Space				2H14: Select and fund at least 3-5 proposals through the HTCI focused R&T program that feature: <ul style="list-style-type: none"> Highly innovative new technology development efforts in selected areas associated with human safety and performance in space (e.g., Extravehicular Activity (EVA) systems)
Assessment				TBD

Meet sustained space operations needs while reducing costs.

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Enable Humans to live and Work Permanently in Space	9H30: Complete the development of a commercialization plan for the ISS and the Space Shuttle in partnership with the research and commercial communities, and define and recommend policy and legislative changes.	0H39: Promote privatization of Space Shuttle operations and reduce civil service resource requirements for operations by 20% (from the FY 1996 FTE levels) in FY 2000.		
	Yellow	Red		
Enable Humans to live and Work Permanently in Space	9H34: Develop options and recommendations to commercialize space communications.	0H42: Increase the expenditures for commercial services to 10% of the total space communications budget by FY 2000.	1H20: Increase the percentage of the space operations budget allocated to acquisition of communications and data services from the commercial sector to 15%.	2H15: The Space Communications program will conduct tasks that enable commercialization and will minimize investment in government infrastructure for which commercial alternatives are being developed.
Assessment	Red	Green	TBD	TBD
Enable Humans to live and Work Permanently in Space		0H40: Promote privatization and commercialization of Space Shuttle payload operations through the transition of payload management functions (payload integration managers, payload officers, etc.) by FY 2000.	1H21: Achieve at least 95 percent of planned data delivery from space flight missions as documented in space, ground, deep space, and NASA integrated service networks performance metrics consistent with detailed program and project operations requirements in project service level agreements.	2H16: Performance metrics for each mission will be consistent with detailed program and project operations requirements in project Service Level Agreements <ul style="list-style-type: none"> • Achieve at least 95 percent of planned data delivery for space flight missions.
Assessment		Green	TBD	TBD

Meet sustained space operations needs while reducing costs.

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Enable Humans to live and Work Permanently in Space		0H41: Within policy limitations and appropriate waivers, pursue the commercial marketing of Space Shuttle payloads by working to allow the Space Flight Operations Contractor to target two reimbursable flights, one in FY 2001 and one in FY 2002.		
Assessment		No longer applicable - see 2000 Performance Report		
Enable Humans to live and Work Permanently in Space	9H33: Reduce space communications operations costs by 30 to 35% compared to the FY96 budget, through a consolidated space communications contract to meet established budget targets.	0H43: Reduce the space communications budget submit for FY 2000 by 30-35% from the FY 1996 congressional budget submit.		
Assessment	Green	Green		

Improve the accessibility of space to meet the needs of commercial research and development.

Enable the Commercial Development of Space				2H17: Provide an average of five mid-deck lockers on each Space Shuttle mission to the International Space Station for research.
Assessment				TBD

Improve the accessibility of space to meet the needs of commercial research and development.

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Enable the Commercial Development of Space				2H18: Establish mechanisms to enable NASA access to the use of U.S. commercially developed launch systems.
Assessment				TBD

Foster commercial endeavors with the International Space Station and other assets.

Enable the Commercial Development of Space				2H19: Develop and execute a management plan and open future Station hardware and service procurements to innovation and cost-saving ideas through competition, including launch services and a Non-Government Organization for Space Station research.
Assessment				TBD

Develop new capabilities for human space flight and commercial applications through partnerships with the private sector

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Enable the Commercial Development of Space		0H44 Invest 25% of the space communications technology budget by FY 2000 in projects that could enable space commercial opportunities, including leveraging through a consortium of industry, academia, and Government.		
Assessment		Green		

Develop new capabilities for human space flight and commercial applications through partnerships with the private sector

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Enable the Commercial Development of Space			1H23: Foster commercial endeavors by reviewing and/or implementing new policies and plans, such as the Space Station resource pricing policy and intellectual property rights policy. Ensure that Space Station resources allocated to commercial research are utilized by commercial partners to develop commercial products and improve industrial processes.	
Assessment			TBD	
Enable the Commercial Development of Space				2H20: Conduct a competitive solicitation and selection process that will fund through the HEDS research and technology program HTCI (HEDS Technology and Commercialization Initiative): <ul style="list-style-type: none"> • Systems studies assessing the commercial potential associated with various prospective HEDS infrastructures/capabilities, • New technology development and demonstration efforts with potential longer-term commercial space value
Assessment				TBD

Develop new capabilities for human space flight and commercial applications through partnerships with the private sector

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Enable the Commercial Development of Space				2H21: Continue implementation of planned and new privatization efforts through the Space Shuttle prime contract and further efforts to safely and effectively transfer civil service positions and responsibilities to the Space Shuttle contractor.
Assessment				TBD

Engage and involve the public in the excitement and the benefits of—and in setting the goals for—the exploration and development of space.

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Share the Experience and Benefits of discovery				2H22: Competitively select and fund at least 5 activities to identify potential opportunities for high public value HEDS activities, including potential media access and/or public involvement in future HEDS missions.
Assessment				TBD

Provide significantly more value to significantly more people through exploration and space development efforts.

Share the Experience and Benefits of discovery				2H23: Establish a focused customer engagement process to significantly increase our value to significantly more people by enabling the public to guide the formulation of HEDS goals, objectives, programs and missions.
Assessment				TBD

Provide significantly more value to significantly more people through exploration and space development efforts.

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Share the Experience and Benefits of discovery				2H24: Expand public access to HEDS missions information (especially ISS) by working with industry to create media projects and public engagement initiatives that allow “first-hand” public participation using telepresence for current missions, and virtual reality or mock-ups for future missions beyond Earth orbit.
				TBD

Advance the scientific, technological, and academic achievement of the Nation by sharing our knowledge, capabilities, and assets.

	<u>FY 1999</u>	<u>FY 2000</u>	<u>FY 2001</u>	<u>FY 2002</u>
Share the Experience and Benefits of discovery				2H25: Establish initial partnerships with educators at all levels (K-12 and universities) in order to increase the involvement of faculty and students in HEDS.
Assessment				TBD

Human Exploration and Development of Space FY 2002	Budget Category	Advanced Programs	Expendable Launch Vehicles and Payloads	Space Communications	Space Shuttle	Space Station
Annual Performance Goal						
2H1: Begin the development of high-leverage technologies to enable safe, effective and affordable human/robotic exploration missions beyond LEO.		X				
2H2: Test at the International Space Station competing technologies for human missions beyond LEO, in cooperation with other agencies and international partners, and with US industry.						X
2H3: Provide reliable launch services for approved missions.			X			
2H4: Identify and evaluate candidate approaches for 100- to 1000- day human missions capable of a 5- to 10- fold cost reduction--while increasing safety and effectiveness (compared to 1990s projections).		X				
2H5: Develop and test --on the ground and in space-- competing technologies for human missions beyond LEO in cooperation with international partners.		X				
2H6: Assure public, flight crew, and workforce safety for all Space Shuttle operations, measured by the following: <ul style="list-style-type: none"> • Achieve zero type A or B mishaps in FY 2002. • Achieve an average of 8 or fewer flight anomalies per Space Shuttle mission 					X	
2H7: Safely meet the FY 2002 manifest and flight rate commitment. Annual performance goal is measured for Space Shuttle performance only.					X	
2H8: Maintain a "12-month" manifest preparation time.			X			

Human Exploration and Development of Space FY 2002	Budget Category	Advanced Programs	Expendable Launch Vehicles and Payloads	Space Communications	Space Shuttle	Space Station
Annual Performance Goal						
2H9: Have in place a Shuttle safety investment program that ensures the availability of a safe and reliable Shuttle system for ISS assembly and operations.					X	
2H10: Demonstrate ISS on-orbit vehicle operational safety, reliability, and performance.						X
2H11: Demonstrate ISS program progress and readiness at a level sufficient to show adequate readiness in the assembly schedule.						X
2H12: Successfully complete 90% of the ISS planned mission objectives.						X
2H13: Demonstrate progress toward ISS research hardware development.						X
2H14: Select and fund at least 3-5 proposals through the HTCI focused R&T program that feature: o Highly innovative new technology development efforts in selected areas associated with human safety and performance in space (e.g., Extravehicular Activity (EVA) systems)		X				
2H15: The Space Communications program will conduct tasks that enable commercialization and will minimize investment in government infrastructure for which commercial alternatives are being developed.				X		
2H16: Performance metrics for each mission will be consistent with detailed program and project operations requirements in project Service Level Agreements				X		

Human Exploration and Development of Space FY 2002	Budget Category	Advanced Programs	Expendable Launch Vehicles and Payloads	Space Communications	Space Shuttle	Space Station
Annual Performance Goal						
2H17: Provide an average of five mid-deck lockers on each Space Shuttle mission to the International Space Station for research.						X
2H18: Establish mechanisms to enable NASA access to the use of U.S. commercially developed launch systems.			X			
2H19: Develop and execute a management plan and open future Station hardware and service procurements to innovation and cost-saving ideas through competition, including launch services and a Non-Government Organization for Space Station research.						X
2H20: Conduct a competitive solicitation and selection process that will fund through the HEDS research and technology (R&T) program HTCI (HEDS Technology and Commercialization Initiative): o Systems studies assessing the commercial potential associated with various prospective HEDS infrastructures/capabilities, o New technology development and demonstration efforts with potential longer-term commercial space value.		X				
2H21: Continue implementation of planned and new privatization efforts through the Space Shuttle prime contract and further efforts to safely and effectively transfer civil service positions and responsibilities to the Space Shuttle contractor.					X	

Human Exploration and Development of Space FY 2002	Budget Category	Advanced Programs	Expendable Launch Vehicles and Payloads	Space Communications	Space Shuttle	Space Station
Annual Performance Goal						
2H22: Competitively select and fund at least 5 activities to identify potential opportunities for high public value HEDS activities, including potential media access and/or public involvement in future HEDS missions.		X				
2H23: Establish a focused customer engagement process to significantly increase our value to significantly more people by enabling the public to guide the formulation of HEDS goals, objectives, programs and missions.		X				
2H24: Expand public access to HEDS missions information (especially ISS) by working with industry to create media projects and public engagement initiatives that allow “first-hand” public participation using telepresence for current missions, and virtual reality or mock-ups for future missions beyond Earth orbit.						X
2H25: Establish initial partnerships with educators at all levels (K-12 and universities) in order to increase the involvement of faculty and students in HEDS.		X				